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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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03/01/2006

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EXAMINER

EDWARDS, PATRICK L

ART UNIT

PAPER NUMBER

2621

DATE MAILED: 03/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/803,802	Applicant(s) CHEN ET AL.	
	Examiner Patrick L. Edwards	Art Unit 2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 2, 4, 6-13, 15-17 and 19-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 4-13, 15, 17 and 19 is/are allowed.
- 6) ☒ Claim(s) 1, 2, 16, 21-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12-13-2005 has been entered.

Response to Arguments

2. Applicant's arguments filed on 10-24-2005 have been fully considered. A response to these arguments is provided below.

Prior Art Rejections

Summary of Argument:

(a) Regarding claims 1 and 22, applicant has amended the claim and argues that this claim is no longer anticipated by "renowned institution." In the 'remarks' section, applicant restates the rejection to claim 1 (see pg. 10); recites the amended language of claim 1 (see pg. 11); points to excerpts of the specification that support and describe the new claim language (see pgs. 11-12); and then, finally, states that 'renowned institution does not disclose the amended limitation because it "deals with range images having ambiguity in capture position" (see the top of pg. 13). This single sentence (which is followed by a paragraph from the reference) is the entire analysis given by the applicant.

(b) Regarding claim 16, applicant has amended the claim and argues that this claim is no longer made obvious by the 'renowned institution' reference. The structure of argument mirrors the structure used in the claim 1 argument. In contrast to claim 1, though, applicant makes a substantive argument about the 'renowned institution's' disclosure of an automated system. Specifically, applicant argues that this is insufficient to make the claim limitation obvious.

(c) Applicant has amended the remaining independent claims and directs arguments to the effect that the claims are now allowable over the cited references.

Examiner's Response:

(a) The 'renowned institution' reference still meets the limitations of the claim. A rejection is kindly provided below. Further, it should be noted that applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

(b) Applicant's argument has been fully considered but is unpersuasive. The previous rejection sufficiently explained why one reasonably skilled in the art would find it obvious to automate the system in light of the 'renowned institution's' disclosure.

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(c) The examiner has taken all of these arguments into consideration and is persuaded that the new limitations get around the teachings of the 'renowned institution.' These claims will be indicated as allowable.

Allowable Subject Matter

3. Claims 4-13, 15, 17, and 19 allowed.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1 and 22-24 are rejected under 35 U.S.C. 102(b) as being anticipated by R.T. Whitaker, J. Gregor, P.F. Chen, University of Tennessee (hereinafter 'renowned institution') with the paper, "Indoor Scene Reconstruction from Sets of Noisy Range Images". This paper was published in 1999 at IEEE's Second International Conference on 3-D Imaging and Modeling.

With regard to claim 1, 'renowned institution' discloses a method for deriving a 3-D panorama from a plurality of images of a scene generated by a range imaging camera that produces ambiguities in range information (see the first paragraph of the 'Introduction': The reference describes deriving a 3-D model of an 'entire scene' (i.e. a panorama). The reference further describes that the images are 'laser range images' or 'LADAR data'. The applicant's disclosure (see paragraph [0027], *inter alia*) explains that the claimed range imaging camera that produces the range information is a laser radar. Accordingly, the reference anticipates this limitation.

'Renowned institution' further discloses acquiring a plurality of adjacent images of the scene, said adjacent images each having a known capture position defining a known spatial relation between said adjacent images, wherein there is an overlap region between the adjacent images and at least some of the adjacent images are range images, said range images each having relative range values, said range images differing by said known spatial relation and an unknown relative range difference (see Figure 4a-b in conjunction with the reference's description of determining camera pose: The reference describes two embodiments. One in which a pose estimate is unavailable at the time of image capture, and another where a pose estimate is available at the time of image capture (this is discussed on the left side of the 2nd page of the reference). This second embodiment meets the claimed limitation because we have a known spatial relation (i.e. the approximate pose estimate), but our range difference (i.e. the range distance) is unknown until the system comes up with an estimate.).

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'Renowned institution' further discloses estimating a relative range difference between adjacent range images to provide an estimated constant offset between the adjacent images; and optimizing said estimated constant offset to provide an optimized constant offset (page 1, col. 2, final paragraph, the reference describes determining a distance between views. The reference further elaborates on the view registration (or pose determination, see pg. 1, col. 2, the first two lines of the second paragraph) method and the plane offsets (pg. 4 – col. 2) by defining variables ω_1 and ω_2 , which are plane offsets. This shows a constant offset between adjacent range images as required by the claim. The above cited passage also shows an initial estimate of range difference which is subsequently optimized by a singular value decomposition operation to make the estimate more robust. This is in accord with applicant's own disclosure, which teaches using singular value decomposition for optimization of range estimates (applicant's disclosure paragraph [0034]).

Regarding claim 22, 'renowned institution' discloses that the optimization process includes several computations (pg. 4 – col. 2). The reference further discloses that the process is performed on a computer (pg. 7 – col. 2). Thus, the optimization is automatic.

Regarding claims 23 and 24, 'renowned institution' discloses that the estimation of the range difference uses a spatial relation between the two images (see 'renowned institution' pg. 4: As was previously explained, the reference describes using spatial relation estimates in the estimate of the range difference. The spatial relation is a pose estimate mentioned previously in the paper.).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over 'renowned institution'. The arguments as to the relevance of 'renowned institution' as applied above are incorporated herein.

'Renowned institution' further discloses deriving a 3D panorama from said range images and said optimized constant offset. This was discussed above with respect to the preamble of claim 1. As was stated, the 'entire scene' is analogous to the claimed 'panorama'. These two terms are definitionally equivalent (see websters dictionary).

'Renowned institution' further discloses providing offset data for the range images (pg. 1 col. 2., final paragraph: The reference describes determining 'distances between views'. This is analogous to providing offset data as recited in the claim.) in order to recover corrected relative scene spatial information (pg. 1 col. 2, lines 4-7: The reference describes registering separate viewpoints and then integrating those viewpoints. This is analogous to

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recovering the relative scene spatial information. Furthermore, the second paragraph of the right column of page 2 describes a smoothing preprocessing operation is performed before all of the other processes. Smoothing qualifies as a type of 'correction'; therefore the reference also meets the claimed limitation of 'corrected relative scene spatial information.').

The 'renowned institution' further discloses applying this offset data to correct for ambiguities in the relative ranges of the range images, thereby providing corrected range images. As was stated in the paragraph above, the 'renowned institution' discloses determining range differences between adjacent range images. These offsets are analogous to the ambiguities recited in the claim (also see pg. 2 – col. 1 – final paragraph: this passage makes explicit mention of the ambiguities associated with the range images). The passage cited in the above paragraph shows how the range differences are used in the determination of a translation which aligns, registers, or fits these images together, thereby providing corrected range images.

'Renowned institution' inherently discloses a computer program product because a computer performing a process is disclosed at pg. 7.

Regarding the additional limitation of "automatically providing offset data": 'renowned institution' does not anticipate this limitation because it requires user input. However, 'renowned institution' does expressly state that "Our ultimate goal is a totally automated system, and to this end we have designed the system to rely on user input only for the scan-to-scan plane correspondences, which we hope to automate in future implementations. It would have been obvious to one reasonably skilled in the art at the time of the invention to follow the suggestion of the 'renowned institution' and totally automate the existing system. Such a modification would have allowed for a system that could be executed without the added cost of user interaction

8. Claims 2 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of the 'renowned institution' and Hsieh et al. (USPN 6,011,558). The arguments as to the relevance of 'renowned institution' as applied to claims 1, 16, and 22 above are incorporated herein. Further, the motivation to modify 'renowned institution' from claim 16 above is also incorporated herein.

Referring to claim 2, the 'renowned institution' discloses that the scene spatial information is provided as image values in a local 3D coordinate system of each of the images (pg 2 – col. 2 – 1st paragraph). The 'renowned institution' further discloses performing transformation calculations on a 3D grid (see pg. 7 – col. 2 – 1st paragraph). The examiner feels that a reasonably compelling argument could be made that the transformation to this 3D grid from the local 3D scanning coordinates is inherent in the system. However, the examiner agrees that this feature is not explicitly stated in the reference, and will err on the side of caution and meet the limitation more convincingly with the teachings of Hsieh.

The Hsieh reference discloses transforming the image values from the local coordinate system of each image to a world coordinate system, thereby providing a transformed image (Hsieh col. 1 line 43 – col. 2 line 9 in conjunction with Figure 2: The reference discloses transforming the captured image plane's 10 coordinate system $P(x,y)$ to the

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cylindrical map coordinates $p(u,v)$. The cylindrical map coordinates are analogous to the world coordinate system recited in the claim. This coordinate transformation is performed for all of the captured image planes. Thus, the reference meets the plural claim language.

Hsieh further discloses warping a plurality of transformed images onto a cylindrical surface (Hsieh col. 2 lines 7-10); registering adjacent warped images (Hsieh col. 4 lines 33-35 in conjunction with figures 4a-b); and deriving the panorama using the warped images (Hsieh col. 2 lines 16-17).

It would have been obvious to one reasonably skilled in the art at the time of the invention to modify 'the renowned institutions' method of deriving a 3D panorama by transforming and mapping the captured image planes into a cylindrical shape as taught by Hsieh. Such a modification would have allowed for the building of a virtual environment map (Hsieh col. 1 lines 40-41).

Regarding claim 21, both 'renowned institution' and Hsieh disclose the additional limitation of repeating the operations for a number of iterations until an acceptable error is attained ('renowned institution' at pg. 4 col. 2 & Hsieh at col. 5 lines 46-59).

9. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over 'renowned institution' and further in view of well known prior art. The arguments as to the relevance of 'renowned institution' as applied above are incorporated herein.

Regarding claim 25, 'renowned institution' discloses a spatial relation between two captured images, but does not expressly disclose this spatial relation as an angular offset. However, 'renowned institution' does disclose keeping the camera at a constant position with respect to a vertical axis and so it would have been obvious to one of reasonable skill in the art at the time of the invention to use angular offset as the spatial relation (official notice). Indeed, an argument could be made that this angular offset is inherent in 'renowned institution' since the reference discloses that the camera doesn't move with respect to a vertical access. However, this limitation is not express, and so the rejection to claim 25 will be made under 35 USC 103.

Double Patenting

10. Applicant is advised that should claim 1 be found allowable, claim 22 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

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Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick L Edwards whose telephone number is (571) 272-7390. The examiner can normally be reached on 8:30am - 5:00pm M-F.

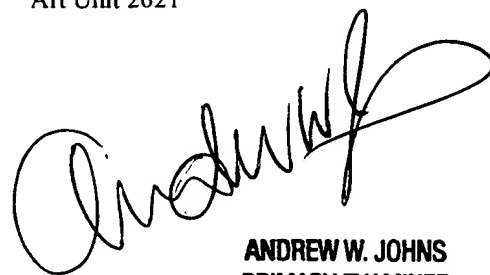
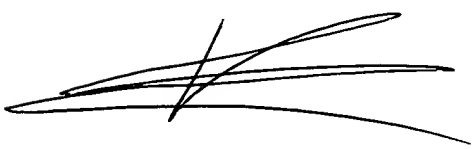
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joe Mancuso can be reached on (571) 272-7695. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Patrick L Edwards

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**ANDREW W. JOHNS
PRIMARY EXAMINER**